

CLAIMS

We claim:

1. A method of making a roll end for a roll in a paper or board machine or in a finishing machine, the roll end comprising a whole having an axle journal with an end flange, as well as a duct system situated inside the material of the roll end, the method comprising making the roll end by a powder metallurgy process in a mould such that the duct system has portions within the end flange of the roll end, the duct system end flange portions being formed in connection with the stage of making the roll end by the powder metallurgy process.
3. The method of claim 1 further comprising the step of forming portions of the duct system in the axle journal of the roll end in connection with the stage of making the roll end by the powder metallurgy process.
4. The method of claim 1 wherein the roll end is made by a hot isostatic pressing process.
5. The method of claim 1 wherein the step of forming the duct system by the powder metallurgy process further comprises:
 - first making a finished construction out of pipes by welding;
 - placing the thus made finished construction in the mould;
 - filling the mould with a metal powder; and
 - carrying out the manufacture under hot isostatic pressure such that the pipe system remains in the material of the roll end, to form the duct system.
6. The method of claim 1 wherein, when the duct system is made, at least one encased cavity is formed on a pipe positioned within the axle journal by a closed sleeve disposed on said at least one pipe.

7. A method of claim 6 wherein the at least one cavity is left empty.
8. The method of claim 6 wherein the at least one cavity is provided with a vacuum by suction.
9. The method of claim 1 wherein the duct system is formed of a pipe system positioned within the mould prior to filling the mould with a metal powder and applying pressure, and wherein the pipe system is coated on a pipe outside with a heat insulating coating layer before the pipe system is disposed in the mould.
10. The method of claim 9 wherein the coating is accomplished by flame spraying or by plasma spraying.
11. The method of claim 9 wherein the heat insulating coating layer is zirconium oxide.
12. The method of claim 1 wherein a high-alloy material is used as the powder metal material in the powder metallurgy process.
13. The method of claim 12 wherein the high-alloy material is a gas-atomised medium-carbon tempering steel powder.
14. The method of claim 1 wherein, in the axle journal of the roll end, a powder material that conducts heat more poorly than steel, is used at a desired depth in the region intended to be under a bearing.
15. The method of claim 14 wherein the powder material that conducts heat more poorly than steel is a metal matrix composite.

16. The method of claim 1 wherein the duct system is formed by a pipe system made out of seamless pipe or hollow bar.

17. The method of claim 16 wherein the seamless pipe or hollow bar is formed of austenitic stainless steel.

5 18. A method of claim 1 wherein the method includes the steps of forming a roll end blank in the powder metallurgy process, dismantling, breaking or machining off the mould from the blank, and machining the blank into a desired shape and dimensions.

10 19. A method of making a roll end for a heatable roll in a paper or board machine or in a finishing machine, which roll end comprises a whole formed by an end flange and an axle journal, as well as a duct system which is situated inside the material of the roll end and through which in the finished roll end a heat transfer medium intended for heating the roll is arranged to circulate from outside the roll through the axle journal and the roll end into bores of a roll shell and back, wherein
15 the roll end is made by a powder metallurgy process in a mould such that at least a duct system intended for the heat transfer medium and placed in the end flange of the roll end is formed in connection with the stage of making the roll end by the powder metallurgy process.

20. A roll in a paper or board machine or in a finishing machine, the roll comprising:

a roll shell having two shell ends; and

two roll ends, each roll end having an end flange and an axle journal, the roll

5 ends being attached to the ends of the roll shell in the axial direction, wherein at least one roll end is provided with an axial central duct and with connecting ducts connecting the central duct to an interior of the roll or to the roll shell, and wherein the roll end is made by a powder metallurgy process and that at least the connecting ducts
10 provided in it are formed in connection with the making of the roll end by the powder metallurgy process.

21. The roll of claim 20 wherein the central duct of the roll end is also formed in connection with the making of the roll end.

22. The roll of claim 20 wherein the duct system situated in the roll end is
15 made in advance into a finished construction out of pipes by welding, which construction is left inside the material of the roll end in connection with the making of the roll end.

23. The roll of claim 20 wherein the connecting ducts of the roll end
20 comprise a radial portion communicating with the central duct and an axial portion communicating from the end flange with the interior of the roll, with the roll shell or with the axial ducts of the roll shell.

24. The roll of claim 23 wherein between the radial portion and the axial portion of the connecting ducts there is a curved portion connecting them.

25. The roll of claim 23 wherein the axial portions of the connecting
25 ducts come perpendicularly out of the end flange of the roll end.

26. The roll of claim 20 wherein each connecting duct in the roll end is arranged to lead as a separate duct to the central duct of the roll end.

27. A heatable roll in a paper or board machine or in a finishing machine, which roll comprises a roll shell and roll ends which comprise an end flange and an axle journal and which are attached to the ends of the roll shell in the axial direction, the roll shell being provided with axial ducts for a flow of a heat transfer medium and at least one of the roll ends being provided with an axial central duct for passing the heat transfer medium into the roll and out of it, as well as with connecting ducts connecting the central duct and the axial ducts of the roll shell wherein the roll end is made by a powder metallurgy process and that at least the connecting ducts which are provided in it and which connect the axial central duct and the axial ducts of the roll shell are formed in connection with the making of the roll end.

28. A method of making a roll end for a heatable roll in a paper or board machine or in a finishing machine, comprising the steps of:

placing a duct system comprised of a plurality of connected pipes within a mould;

filling the mould around the duct system with a metal powder;

applying heat and pressure to the metal powder within the mould to form the metal powder into a desired shape; and

removing the mould from the roll end, in which the duct system comprises at least one duct extending through an axle journal of said roll end, and at least one duct connected to the axle journal duct which extends through an end flange of the roll end, the duct system being intended for conveyance of a heat transfer medium from exterior the roll end into the roll end.

27. A heatable roll in a paper or board machine or in a finishing machine, the roll comprising:

a roll shell having a plurality of axial ducts therein for the flow of a heat transfer medium therethrough; and

5 two roll ends on opposite ends of the roll shell, each roll end having an axially extending journal, with an end flange which extends radially therefrom, the end flanges of the roll ends being attached to the opposite ends of the roll shell, wherein at least one of the roll ends has an axial central duct for passing the heat transfer medium into the
10 roll shell axial ducts and out of it, said at least one roll end having connecting ducts which connect the roll end central duct and the roll shell axial ducts, the at least one roll end being made by a powder metallurgy process and at least the connecting ducts being formed of pipes molded within the at least one roll end.

15 28. The heatable roll of claim 27 further comprising at least one encased cavity is formed on a pipe positioned within the axle journal by a closed sleeve.

29. The heatable roll of claim 27 wherein the pipes are coated with a heat insulating coating layer.

20 30. The heatable roll of claim 27 wherein the connecting ducts of the roll end comprise a radial portion communicating with the central duct and an axial portion communicating from the end flange to the exterior of the roll end, and wherein between the radial portion and the axial portion of the connecting ducts there is a curved portion connecting them.

25 31. The heatable roll of claim 27 wherein, in the axle journal of the roll end, a powder material that conducts heat more poorly than steel, is used at a desired depth in the region intended to be under a bearing.

32. The heatable roll of claim 31 wherein the powder material that conducts heat more poorly than steel is a metal matrix composite.